

Abstract of the Disclosure

Direct metal deposition (DMDtm) is used to fabricate customized three-dimensional artificial joint components, thereby leading to enormous savings in terms of labor, cost and lead-time. The DMD fabrication process is interfaced directly to digital data derived through CAT scans, MRI or X-ray topography. A computer-aided design (CAD) file is then constructed in accordance with the digital data, and a tool path is generated as a function of the CAD file. The desired implant, or a portion thereof (such as just the outer surface) is then be fabricated by depositing material increments along the tool path using direct metal deposition (DMD). The process may be used for both solid and scaffold structure suitable to bone ingrowth or ongrowth. In the preferred embodiment, a closed-loop DMD process is used wherein the size of the increments are controlled through optical monitoring. The materials forming the implant may include one or more metals, polymers, or ceramics, including zirconia or alumina. The same DMD process may also be used to fabricate the implant out of different materials, including a combination metals, ceramics, or polymers. As a further advantage, one or more sensors may be embedded into the implant during fabrication for diagnostic or data-acquisition purposes.